

IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Previously Presented): In an authentication system in which an authentication server which authenticates a user, a user terminal which transmits a user authentication information, and an application server which provides a service to the user through the user terminal are connected together to enable a communication therebetween through a network, the address based authentication system including:

the authentication server which comprises  
authentication means for authenticating a user based on the user authentication information transmitted together with a key information as an authentication request from the user terminal, the key information representing a public key  $K_{PU}$  of the user terminal;  
an address allocating means for allocating an address to the user terminal for a successful authentication of the user;  
generating means for generating information-for-authentication using at least the allocated address;  
a ticket issuing means for issuing a ticket containing the allocated address, the key information which is received from the user terminal and the information-for-authentication;  
and a ticket transmitting means for transmitting the ticket issued by the ticket issuing means to the user terminal;  
the user terminal which has a pair of the public key  $K_{PU}$  and a private key  $K_{SU}$  and comprises:  
transmitting means for transmitting the user authentication information and the key information to the authentication server for purpose of an authentication request;

a ticket reception means for receiving the ticket which contains the allocated address, the key information and the information-for-authentication and which is transmitted from the authentication server;

means for setting up the allocated address contained in the ticket as a source address for each packet which is to be transmitted from the user terminal to the application server;

a first session key generating means for calculating a first session secret key which is shared with the application server, from the private key  $K_{SU}$  of the user terminal and a public key  $K_{PS}$  of the application server;

a packet cryptographic processing means for processing each packet to be transmitted to the application server by the first session secret key to guarantee that there is no forgery in each packet;

means for transmitting a first packet including the ticket to the application server for establishing a session; and

a service request means for transmitting a second packet requesting the service to the application server through the session;

and the application server which has a pair of the public key  $K_{PS}$  and a private key  $K_{SS}$  and comprises:

a second session key generating means for calculating a second session secret key which is shared with the user terminal, from the private key  $K_{SS}$  of the application server and the public key  $K_{PU}$  of the user terminal;

a packet verifying means for confirming whether or not each packet received from the user terminal is forged using the second session secret key;

a ticket memory means for storing the ticket transmitted from the user terminal;

ticket verifying means for verifying the presence or absence of any forgery in the information-for-authentication in the ticket transmitted from the user terminal to determine if

the allocated address contained in the ticket is forged or not and preventing the ticket from being stored in the ticket memory means in the presence of a forgery and further verifying whether or not the key information contained in the ticket in the first packet, which has been verified as not being forged, is the key information representing the public key  $K_{PU}$  of the user terminal, and if not, prevent the ticket from being stored in the ticket memory means;

an address comparison means for determining whether or not the allocated address contained in the ticket which is stored in the ticket memory means coincides with the source address of the second packet which is transmitted from the user terminal through the session; and

a service providing means for transmitting to the user terminal packets which provide the service to the user when a coincidence between the addresses is determined by the address comparison means.

Claim 2 (Cancelled).

Claim 3 (Previously Presented): The authentication system according to Claim 1 the application server further comprising an address collating means for collating the allocated address in the ticket transmitted from the user terminal against the source address of the first packet which includes the ticket and for preventing the ticket from being stored in the ticket memory means if a coincidence is not found.

Claim 4 (Previously Presented): The authentication system according to Claim 1 in which the authentication server comprises a user identifier allocating means for allocating a

user identifier which corresponds to the authenticated user in response to the authentication request for a successful authentication of the user,

the ticket issuing means being configured to issue the ticket inclusive of the user identifier.

Claim 5 (Previously Presented): The authentication system according Claim 1 in which the authentication information generating means of the authentication server is configured to process the information including the allocated address with a shared secret key which is shared beforehand between the authentication server and the application server, the ticket verifying means of the application server is configured to further verify the information-for-authentication contained in the ticket using a shared secret key which is beforehand shared between the authentication server and the application server.

Claim 6 (Cancelled).

Claim 7 (Currently Amended): An authentication server in an authentication system in which an authentication of a user utilizing a user terminal is performed through the user terminal by an authentication server and a request is made to an application server to provide a service on the basis of the authentication, comprising

a reception means for receiving an authentication request inclusive of a user authentication information and key information representing a public key  $K_{PU}$  of the user terminal both transmitted from the user terminal;

an authentication means to which the user authentication information of the received authentication request is input and which authenticates the user on the basis of the user

authentication information and providing a signal indicating a successful authentication upon a successful authentication;

an address allocating means for allocating an address to the user terminal in response to an input of the signal indicating a successful authentication of the user;

authentication information generating means for generating information-for-authentication using at least the allocated address and the key information;

a ticket issuing means for issuing a ticket containing the allocated address, the key information, and the information-for-authentication to the user terminal, ~~the user of which is authenticated by the authentication means~~ the application server conducting authentication for providing services to the user terminal based on the ticket, the ticket guaranteeing a correspondence between the user authenticated by the authentication means, the allocated address, and the key information corresponding to the user terminal; and

a ticket transmitting means to which the ticket is input and which transmits the ticket to the user terminal.

**Claim 8 (Previously Presented):** The authentication server according to Claim 7, wherein the authentication information generating means is configured to generate the information-for-authentication by processing at least the allocated address and the key information using a shared secret key which is beforehand shared between the authentication server and the application server.

**Claim 9 (Previously Presented):** The authentication server according to Claim 7, further comprising

a user identifier allocating means for allocating a user identifier which corresponds to the authenticated user in response to the authentication request when authentication of the user is successful,

wherein the authentication information generating means is configured to process the information including the allocated address, the key information and the user identifier to produce the information-for-authentication and the ticket issuing means is configured to combine at least the information-for-authentication, the allocated address, the key information and the user identifier to form the ticket.

Claim 10 (Previously Presented): The authentication server according to Claim 9 in which the user identifier allocating means is configured to encrypt user information which directly identifies the user by using an identifier-generating secret key  $K_{ID}$  of the authentication server to produce the user identifier.

Claim 11 (Cancelled).

Claim 12 (Currently Amended): A user terminal in an authentication system in which an authentication of a user utilizing a user terminal is performed by an authentication server and a request to provide a service is made to an application server on the basis of the authentication, the user terminal having a pair of a public key  $K_{PU}$  and a private key  $K_{SU}$ , comprising:

a key information generating means to which the public key  $K_{PU}$  of the user terminal is input and which generates a key information representing the public key  $K_{PU}$  of the user terminal;

a user authentication information transmitting means configured to transmit the key information together with a user authentication information to the authentication server;  
a ticket reception means for receiving a ticket transmitted from the authentication server, said ticket containing an address allocated by the authentication server to the user terminal, the key information representing the [[a]] public key K<sub>PU</sub> of the user terminal, and information-for-authentication produced by the authentication server based on using at least the allocated address and the key information, the ticket guaranteeing a correspondence between the user authenticated by the authentication server, the allocated address, and the key information corresponding to the user terminal, the application server conducting authentication for providing services to the user terminal based on the ticket, the user terminal having a pair of the public key K<sub>PU</sub> and a private key K<sub>SU</sub>;

a source address set-up means to which the received ticket is input and which sets up the allocated address contained in the ticket as a source address of each packet to be transmitted to the application server;

a session key generating means to which the private key K<sub>SU</sub> of the user terminal and a public key K<sub>PS</sub> of an application server are input and which calculates a session secret key which is shared with the application server;

a session establishing means to which the ticket is input and which transmits a first packet including the ticket to the application server for establishing a session with the application server using the session secret key;

a service request means for transmitting a second packet representing a service request to the application server through the established session; and  
a generating means to which the public key K<sub>PU</sub> of the user terminal is input and which generates the key information representing the public key K<sub>PU</sub> of the user terminal;

~~a session key generating means to which the private key K<sub>SU</sub> of the user terminal and a public key K<sub>PS</sub> of an application server are input and which calculates a session secret key which is shared with the application server;~~

~~a packet cryptographic processing means to which each packet to be transmitted from the user terminal and the session secret key are input and which processes the packet using the session secret key to guarantee that there is no forgery in each packet;~~

~~a user authentication information transmitting means configured to transmit the key information together with the user authentication information to the authentication server.~~

Claim 13 (Cancelled).

Claim 14 (Currently Amended): A user terminal in an authentication system in which an authentication of a user utilizing a user terminal is performed by an authentication server and a request to provide a service is made to an application server on the basis of the authentication, comprising:

a key information generating means to which an authentication purpose shared secret key KUS which is shared with the application server and a random number which changes each time a session is established are input and which generates a key information by processing the random number by the authentication purpose shared secret key;

a user authentication information transmitting means which is configured to transmit to the authentication server the key information together with the user authentication information for authentication by the authentication server;

a ticket reception means for receiving a ticket transmitted from the authentication server, said ticket containing an address allocated by the authentication server to the user terminal, a key information, and information-for-authentication produced by the

authentication server based on using at least the allocated address and the key information, the ticket guaranteeing a correspondence between the user authenticated by the authentication server, the allocated address, and the key information corresponding to the user terminal, the application server conducting authentication for providing services to the user terminal based on the ticket;

a source address set-up means to which the received ticket is input and which sets up the allocated address contained in the ticket as a source address of each packet to be transmitted to the application server;

a session establishing means to which the ticket is input and which transmits a first packet including the ticket to the application server for establishing a session with the application server;

a service request means for transmitting a second packet representing a service request to the application server through the established session; and

a key information generating means to which an authentication purpose shared secret key  $K_{US}$  which is shared with the application server and a random number which changes each time a session is established are input and which generates a key information by processing the random number by the authentication purpose shared secret key;

a session key generating means to which a private key  $K_{SU}$  of the user terminal and a public key  $K_{PS}$  of an application server are input and which calculates a session secret key which is shared with the application server, the user terminal having a pair of a public key  $K_{PU}$  and the private key  $K_{SU}$ ;

a packet cryptographic processing means to which each packet to be transmitted from the user terminal and the session secret key are input and which processes each packet using the session secret key to guarantee that there is no forgery in each packet; and

~~a user authentication information transmitting means which is configured to transmit the key information together with the user authentication information.~~

Claim 15 (Previously Presented): An application server in an authentication system in which an authentication of a user utilizing a user terminal is performed by an authentication server and a request to provide a service is made to an application server on the basis of the authentication, comprising

a session establishing means for establishing a session with a user terminal in response to a reception of a session establishment request packet containing a ticket from the user terminal, said ticket containing an address allocated by the authentication server to the user terminal, a key information representing a public key  $K_{PU}$  of the user terminal and information-for-authentication generated by the authentication server using at least the allocated address;

a ticket memory means in which the ticket transmitted from the user terminal is stored;

an address comparison means to which a source address of a service request packet which is transmitted from the user terminal and received through the established session is input and which determines whether or not the source address coincides with an allocated address of the user terminal contained in the ticket stored in the ticket memory means; and

a service providing means which provides a service to the user terminal when the output of the address comparison means indicates a coincidence,

wherein said session establishing means comprises a ticket verifying means for verifying authenticity of the ticket, which is received from the user terminal for establishing the session, by checking the information-for-authentication contained in the ticket to determine if the allocated address contained in the ticket is forged or not and preventing the

ticket from being stored in the ticket memory means when verification is not successful, and further verifying whether or not the key information contained in the ticket in the first packet, which has been verified as not being forged, is the key information representing the public key  $K_{PU}$  of the user terminal, and if not, prevent the ticket from being stored in the ticket memory means.

Claim 16 (Cancelled).

Claim 17 (Previously Presented): The application server according to Claim 15, further comprising

a session key generating means for calculating a session secret key which is shared with the user terminal from a private key of the application server and a public key of the user terminal;

and a packet verifying means for verifying whether or not the session establishment request packet received from the user terminal is forged using the session secret key and for preventing the ticket from being stored in response to a verification output indicating the presence of a forgery.

Claim 18 (Previously Presented): The application server according to Claim 17 in which the ticket verifying means comprises collating means for verifying, when the received session establishment request packet has been verified by the packet verifying means as not forged, whether or not key information contained in the ticket corresponds to the public key of the user terminal which has been used in the calculation of the session secret key.

Claim 19 (Previously Presented): The application server according to Claim 15 in which the ticket verifying means comprises terminal authenticating means to which an authentication purpose shared secret key which is shared with the user terminal and a random number which changes each time a session is established are input and which processes the random number using the authentication purpose shared secret key, collates a result of the processing against a key information in the ticket and verifies the authenticity of the ticket by seeing whether or not a matching between the result of processing and the key information applies.

Claim 20 (Previously Presented): An application server according to Claim 15 in which the ticket verifying means comprises means for verifying whether or not the source address of the received session establishment request packet coincides with the allocated address contained in the ticket within the session establishment request packet and for preventing the ticket from being stored in response to a detection output which indicates a non-coincidence.

Claim 21 (Currently Amended): A computer readable storage medium having stored thereon an authentication server program for programming a computer to function as an authentication server in an authentication system in which an authentication of a user utilizing a user terminal is performed through the user terminal by the authentication server and a request is made by the user terminal to an application server to provide a service on the basis of the authentication, the authentication server comprising:

a user authentication information reception means for receiving an authentication request inclusive of a user authentication information and key information representing a public key  $K_{PU}$  of the user terminal both transmitted from the user terminal;

an authentication means to which the user authentication information of the received authentication request is input and which authenticates the user on the basis of the user authentication information and providing a signal indicating a successful authentication upon a successful authentication;

an address allocating means for allocating an address to the user terminal in response to an input of the signal indicating a successful authentication of the user;

authentication information generating means for generating information-for-authentication using at least the allocated address and the key information;

a ticket issuing means for issuing generating a ticket containing the allocated address, the key information, and the information-for-authentication, the ticket guaranteeing a correspondence between the user authenticated by the authentication means, the allocated address, and the key information corresponding to the user terminal, and for issuing the ticket to the user terminal, the application server conducting authentication for providing services to the user terminal based on the ticket the user of which is authenticated by the authentication means; and

a ticket transmitting means to which the ticket is input and which transmits the ticket to the user terminal.

Claim 22 (Currently Amended): A computer readable storage medium having stored thereon a user terminal program for programming a computer to function as a user terminal in an authentication system in which an authentication of a user utilizing a user terminal is performed by an authentication server and a request to provide a service is made to an application server on the basis of the authentication, the user terminal having a pair of a public key K<sub>PU</sub> and a private key K<sub>SU</sub>, comprising:

a key information generating means to which the public key K<sub>PU</sub> of the user terminal is input and which generates a key information representing the public key K<sub>PU</sub> of the user terminal;

a user authentication information transmitting means configured to transmit the key information together with the user authentication information to the authentication server;

a ticket reception means for receiving a ticket transmitted from the authentication server, said ticket containing an address allocated by the authentication server to the user terminal, the key information representing the [[a]] public key K<sub>PU</sub> of the user terminal, and information-for-authentication produced by the authentication server based on using at least the allocated address and the key information, the ticket guaranteeing a correspondence between the user authenticated by the authentication server, the allocated address, and the key information corresponding to the user terminal , the application server conducting authentication for providing services to the user terminal based on the ticket, the user terminal having a pair of the public key K<sub>PU</sub> and a private key K<sub>SU</sub>;

a source address set-up means to which the received ticket is input and which sets up the allocated address contained in the ticket as a source address of the user terminal;

a session key generating means to which the private key K<sub>SU</sub> of the user terminal and a public key K<sub>PS</sub> of an application server are input and which calculates a session secret key which is shared with the application server;

a session establishing means to which the ticket is input and which transmits a first packet including the ticket to the application server for establishing a session with the application server using the session secret key;

a service request means for transmitting a second packet representing a service request to the application server through the established session; and

~~a key information generating means to which the public key  $K_{PU}$  of the user terminal is input and which generates the key information representing the public key  $K_{PU}$  of the user terminal;~~

~~a session key generating means to which the private key  $K_{SU}$  of the user terminal and a public key  $K_{PS}$  of an application server are input and which calculates a session secret key which is shared with the application server;~~

a packet cryptographic processing means to which each packet to be transmitted from the user terminal and the session secret key are input and which processes each packet using the session secret key to guarantee that there is no forgery in each packet;

~~a user authentication information transmitting means configured to transmit the key information together with the user authentication information to the authentication server.~~

Claim 23 (Previously Presented): A computer readable storage medium having stored thereon an application server program for programming a computer to function as an application server in an authentication system in which an authentication of a user utilizing a user terminal is performed by an authentication server and a request to provide a service is made by the user terminal to the application server on the basis of the authentication, the application server comprising:

a session establishing means for establishing a session with a user terminal in response to a reception of a session establishment request packet containing a ticket from the user terminal, said ticket containing an address allocated by the authentication server to the user terminal, a key information representing a public key  $K_{PU}$  of the user terminal and information-for-authentication generated by the authentication server using at least the allocated address;

a ticket memory means in which the ticket transmitted from the user terminal is stored;

an address comparison means to which a source address of a service request packet which is transmitted from the user terminal and received through the established session is input and which determines whether or not the source address coincides with an allocated address of the user terminal contained in the ticket stored in the ticket memory means; and

a service providing means which provides a service to the user terminal when the output of the address comparison means indicates a coincidence,

wherein said session establishing means comprises a ticket verifying means for verifying authenticity of the ticket, which is received from the user terminal for establishing the session, by checking the information-for-authentication contained in the ticket to determine if the allocated address contained in the ticket is forged or not and preventing the ticket from being stored in the ticket memory means when verification is not successful and further verifying whether or not the key information contained in the ticket in the first packet, which has been verified as not being forged, is the key information representing the public key  $K_{PU}$  of the user terminal, and if not, prevent the ticket from being stored in the ticket memory means.

Claim 24 (Previously Presented): The system according to Claim 1, in which the authentication server has a secret key and a public key for a digital signature, and said ticket issuing means comprises:

an authentication information generating means for computing a digital signature on the information including at least the allocated address using the secret key for the digital signature to produce the information for authentication so that the application server can

verify the presence or absence of any forgery in the information for authentication in the ticket using the public key of the authentication server.

Claim 25 (Previously Presented): The authentication server according to Claim 7, wherein the authentication server has a secret key and a public key for a digital signature, and said ticket issuing means comprises:

an authentication information generating means for computing a digital signature on the information including at least the allocated address using the secret key to produce the information for authentication so that the application server can verify the presence or absence of any forgery in the information for authentication in the ticket using the public key of the authentication server.